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1. GENERAL

1.1 Scope

1.1.1 This Engineering Specification covers the requirements for the painting including surface preparation, paint materials, procedure and inspection, of all Mechanical, Electrical, Instrumentation & Automation equipment, Piping and Steel Structure for the plant constructed. 3LPE Coating for Mainline Pipe, Internal coatings and linings are not covered in this Engineering Specification.

1.1.2 This Engineering Specification shall be applied to Vendor's shop painting by VENDOR of All equipment's and machinery (referred to as VENDOR) and Field painting by Construction Contractor (hereinafter referred to as CONTRACTOR). Field painting includes painting at Contractor's Painting shop located at temporary facility area within the site.

1.1.3 This Engineering specification shall not apply to the following painting works.

- a) Painting to be carried out based on manufacturer's specification.
- b) Repainting (Maintenance Work)
- c) Painting of temporary installations.
- d) Painting using methods other than general methods such as brushing and spraying.
- e) Painting intended solely for coloring or marking.
- f) Coating and Lining.
- g) Painting of building except steel structure.

1.2 Codes and Standards

1.2.1 The applicable codes and standards referenced in this Engineering Specification shall be as follows:

1. Steel Structure Painting Council (SSPC)
2. Swedish Standards Institution (SIS)
3. NACE SP0188
4. ISO 12944
5. ISO 8501
6. ASTM-D-3359
7. SSPC PA-2
8. ISO 8504
9. ISO 8502

1.3 Definition

Painting system - Combination of paint films, including surface preparation, from prime coating to finish coating, in order to satisfy the intended purpose and effectiveness of painting.

2. EXTENT OF SURFACES TO BE PAINTED

2.1 Surfaces to be Painted

The extent of painting shall apply to the following for all Bought-out, Shop manufactured & Site fabricated Items

1. Exposed surface of:
 - a) Structural steel
 - b) Tanks, Pressure Vessels, etc.
 - c) Equipment's
 - d) Steel piping and pipe supports, etc.
 - e) Ladders, handrails, platforms, stairways, etc.
 - f) All Electrical, Instrumentation & Automation equipment's.
 - g) All Valves; Control Valves & Relief valves, etc.
2. Surfaces of rotating machinery, except for rotating and sliding contact surfaces.
3. External surfaces of equipment, storage tanks, piping etc. to be covered with cold insulation materials.
4. External surfaces of field fabricated equipment, storage tanks, piping, etc. to be covered with hot insulation materials.
5. All other surfaces, requiring rust and corrosion protection paint.
6. All galvanized fasteners, galvanized structures, galvanized Equipment's, galvanized hand rails & gratings, galvanized electrical equipment's etc.

2.2 Surfaces not to be Painted

The extent basically not requiring painting shall be as follows:

1. Internal surfaces of pipes, equipment, etc. and internal surfaces of closed steel structures which do not require chemical, acid and alkali resistance.
2. Surfaces of steel structures to be fire-proofed with concrete or mortar covering.
3. Surfaces of steel structures embedded or in contact with concrete or mortar.
4. Interior wall surfaces of furnaces, boilers, etc., heating tubes and portions with heat resistant treatment.
5. Friction surfaces to be connected with high tensile strength bolts unless inorganic Zinc rich paint is applied (not permitted without prior approval of OWNER)
6. Part of entire surfaces of items not to be painted, in order to maintain function of plant facilities.

3. EXTENT OF VENDOR'S SHOP PAINTING FOR BOUGHT- OUT ITEMS

3.1 Shop Painting

3.1.1 The Bought-out items, but not limited to the following shall be completely painted in Vendor's shop.

- a) Electrical, Instrumentation & Automation Items
- b) Pumps, motors, compressors, machinery, skid mounted shop assembled units, oil consoles, etc.
- c) Sprinkler heads
- d) Instruments, gauge
- e) Control & Relief valves,
- f) Push buttons, light switches, light fixtures, etc.

3.1.2 All paint materials to be used for Shop painting, both at VENDOR's Shop and CONTRACTOR's FIELD Shop shall be subject to OWNER's prior written consent. Painting systems must be selected after approval from OWNER only.

Surface preparation and painting system for bought out material / equipment's / components shall be in line with Appendix 1 & 2.

4. PAINTING SCHEME

4.1 Painting Systems

4.1.1 Painting systems are listed in **Appendix (1) “Detail of Painting Systems”** attached here to. Painting systems must be selected after approval from OWNER only. Final Color shade shall be as per the recommendation / approval of OWNER.

4.1.2 In case painting systems in **Appendix (1)** are not applicable due to requirement of performance durability or special environment such as salt water immersion, chemical exposure, chemical immersion, etc. Vendor's specification or practice may be applicable subject to OWNER's prior written consent.

4.1.3 Paint materials to be used shall be obtained only from reliable and established Manufacturers only such as AKZONOBLE, HEMPEL, SIGMA, JOTUN or as per contract technical specification.

5. EXECUTION OF PAINTING WORK

5.1 Surface Preparation

5.1.1 Treatment prior to surface preparation

The following work shall be carried out prior to surface preparation.

1. Remove slag, flux and spatter adhered to weld area and steel surfaces.

2. Where substances such as grease and machine oil are found on the surface, remove them with cleaning solvent, steam or other appropriate methods.
3. Remove excessive rust and dirt using appropriate methods.

5.1.2 Execution of surface preparation work

1. The surface preparation of all Carbon Steel / SS Piping and equipment's shall be done by dry abrasive blast cleaning to Sa 2 1/2 finish of near white metal in accordance with ISO 8501-1 Standard procedure and degree of surface preparation are shown in **Table 1 “Classification of Steel Surface Preparation”** for reference.
2. Restrictions concerning surface preparation and protective measures:
 - a) Surface preparation & painting shall not be carried out outdoors and the same shall be carried out in closed / covered sheds.
 - b) When the surface to be prepared is wet, preparation shall not be carried out.
 - c) When the relative humidity is 85 % or higher, surface preparation shall not be carried out.
 - d) When surface preparation is carried out during the night or in dark locations (inside of tanks, etc.), use lighting equipment by means of which the extent of rust removal from the surface can be seen.
 - e) When blast cleaning is to be carried out at the job site, appropriate protective measures shall be taken to ensure prevention of adverse effect of dust on adjacent work or environmental pollution in the surrounding area.

5.1.3 Treatment after surface preparation

After the completion of surface preparation, the following confirmation and work shall be carried out and the subsequent painting shall also be started promptly.

1. When rusting occurs after completion of surface preparation and before painting, carry out surface preparation again using appropriate methods.
2. The painting surface shall be fully cleaned of mill scale, rust and other dust accumulated on the surface due to the surface preparation work.
3. The painting surfaces (cleaning of which has also been completed) shall be kept clean in such a way as to prevent the adherence of grease, oil, dust and other detrimental matters until the painting work is started.
4. Salt deposition test shall be conducted on the material that has been stacked for more than two days. This test shall be conducted on sampling basis as detailed below
 - a) Salt deposition test shall be performed randomly after surface preparation and before application of each coat of painting.
 - b) Salt contamination requirement / frequency shall be decided by OWNER on the basis of

site / weather / substrate condition.

Value of acceptance, maximum: 5 Microgram / cm².

- c) If the value exceeds acceptable limit, then the surface has to be cleaned using high pressure (34-70MPA) water (of appropriate quality) cleaning.
- d) Jet washing shall be followed by drying and sweep blasting to required standard. Potable water shall be used for washing, whenever and wherever required.
- e) Area of size 12"X12" to be tested shall be de-dusted properly and shall be washed with water. The washed water shall be collected in a pot and litmus paper to be inserted in the collected water. If the color of the litmus paper changes to brown, then the salt content on the surface is more and it is recommended to flush the material again with water until no salt content is found.
- f) Salt contamination kit shall be arranged by CONTRACTOR and procedure shall be established by technical representative of paint manufacturer. Frequency and area of testing to be performed shall be as per paint manufacturer and client recommendation.

5.2 Abrasives

- 1. Surface shall be cleaned by abrasive blast cleaning (ISO 12944-4 Cl.6.2.3.1.2) in accordance with ISO 8504-2 (Cl. 5.1.2).
- 2. Abrasive blast cleaning shall be carried out using equipment suitably designed for the operation. The pressure should be at least 7 kg/cm² at the nozzle tip. Air used for blasting must be clean, oil free and dry. Moisture and Oil separators have to be used to ensure the same.
- 3. Abrasive used for blasting should be dry and free from dirt, oil, grease, toxic substances, organic matter, mill scale or contamination and shall not have water soluble content exceeding than 0.05%.
- 4. The abrasive must be capable of producing the standard of cleanliness and required surface profile.
- 5. Carbon Steel & LTCS surfaces shall be cleaned by using Copper Slag as an abrasive media. Stainless steel and galvanized steel surfaces shall be cleaned by using Garnets as an abrasive media. Size of copper slag shall be range of 0.5 to 2.0 mm.
- 6. Abrasives shall be used only one time and should not be contaminated with soil.
- 7. Use of silica containing abrasive medium such as Sand, in no case, shall be permitted.

Table 1 Classification of Steel Surface Preparation

Method of Cleaning	Classification	Procedure and Degree of Steel Surface Finish	Reference Standard	
			SIS/ISO	SSPC
Blast	Near-White Blast Cleaning	Very thorough blast cleaning. Mill scale, rust and foreign matter shall be removed to the extent that the only traces remaining are slight stains in the form of spots or stripes. Finally, the surface is cleaned with a vacuum cleaner, clean dry compressed air or a clean brush.	Sa 2 1/2	SP 10
	Commercial Blast Cleaning	Thorough blast cleaning. Almost all mill scale, rust and foreign matter shall be removed. Finally, the surface is cleaned with a vacuum cleaner, clean dry compressed air or a clean brush. It shall then be grayish in color.	Sa 2	SP 6
	Brush-Off Blast Cleaning	Thorough blast cleaning. Tightly adherent mill scale, rust, and coating may remain on the surface. Finally, the surface is cleaned with a vacuum cleaner, clean dry compressed air or a clean brush.	Sa 1	SP 7
Power Tool	Power Tool Cleaning	Very thorough scraping and wire-brushing-machine brushing - grinding - etc. Surface preparation as for St 2, but much more thoroughly. After removal of dust, the surface shall have a pronounced metallic sheen.	St 3	SP 3
	Power Tool Cleaning to Bare Metal	Complete removal of all rust, scale, and paint by power tools, with resultant surface profile.	-	SP 11
Hand Tool	Hand Tool Cleaning	Hand tool cleaning is a method of preparing steel surfaces by the use of non-power hand tools. Hand tool cleaning removes all loose mill scale, loose rust, loose paint, and other loose detrimental foreign matter. It is not intended that adherent mill scale, rust, and paint be removed by this process. Mill scale, rust, and paint are considered adherent if they cannot be removed by lining with a dull putty knife.	St 2	SP 2
Solvent	Solvent Cleaning	Solvent cleaning is a method for removing all visible oil, grease, soil, drawing and cutting compounds, and other soluble contaminants from steel surfaces. It is intended that solvent cleaning be used prior to the application of paint and in conjunction with surface preparation methods specified for the removal of rust, mill scale, or paint.	-	SP 1
Pickling	Pickling	Complete removal of rust and mill scale by acid pickling, duplex pickling, or electrolytic pickling.	-	SP 8

Recommended Surface Preparation: Sa 2 1/2 / SSPC-SP10

The surface profile on blast cleaned surface shall be anchor (angular) profile as given below:

For carbon steel surfaces with total coating thickness below 500 μ : 50 -70 microns trough to peak

For stainless steel & galvanized surfaces with total coating thickness below 500 μ : 40-60 microns trough to peak.

However, selection of Surface preparation and painting system for Low temperature services must be certified and approved from all relevant statutory & regulatory bodies.

5.3 Execution of Painting Work

5.3.1 Protection

Contractor shall fully protect all equipment's, piping, walls, floors and other surfaces from damage and contamination, and shall provide the necessary protection required to fully protect all surfaces from dust, paint droppings, paint mist, other contaminants during the execution of painting work. Especially, the particular care must be exercised to protect all stainless steel surfaces from zinc paint.

5.3.2 Mixing of paint materials

1. Paint materials shall be thoroughly stirred by using Mechanical Agitator as it is mandatory requirement.
2. For multi-liquid type paint materials, the specified mixing ratio and pot life shall be observed.

5.3.3 Application

1. Painting tools suitable for the properties of the paint materials shall be used according to manufacturer's recommendation and studying work location, environment, shape of the items to be painted, and condition of surface to be painted.
2. Each coat shall be painted in the order of the specified type of paint. In this case, for the coating of each film, observe the interval between coats and film thickness specified according to the properties and performance of the paint materials as per Paint manufacturer recommendation.
3. Where each coat is applied successively, such continuous painting work shall be carried out after the lapse of specified drying time and drying of previous film has been confirmed.

5.3.4 Restrictions concerning painting

Unless special measures are taken, painting shall not be carried out under the following conditions:

1. When the painting surfaces are moist or likely to become moist due to rain, snow, dew or frost.
2. When the temperature during painting is 5 deg C or lower and is not suitable for drying and hardening of paint materials.
3. When the relative humidity is 85 % or more.
4. When the temperature of painting surfaces is high and defects such as air bubbles may occur in the paint film.
5. When a strong wind is blowing and foreign matters such as sand may adhere to the paint film.

6. REPAIR PROCEDURE

6.1 Repairs of major / minor areas when the primer paint is damaged.

If the primer coat is damaged, the entire paint system as detailed in **Appendix (1)** to be repeated without any exception.

The recommendations given earlier for surface preparation, coating application etc., MUST be adhered to.

6.2 Repairs when the primer is intact & the second coat is damaged

This covers the repairs to areas damaged either at the initial coating stage or caused during service, mechanical damages, handling damages, etc.

The principle requirements are:

- i. Removal of any corrosion by means of either vacuum blasting or hand tools like disc sander and grinder.
- ii. Abrade the area surrounding the repair for subsequent paint application.

Surface Preparation: Proper feathering and roughening at the coating damaged area.

Salt contamination to be checked and if it is higher than the acceptable limit, then the surface has to be cleaned using high pressure (34-70MPA) water (of appropriate quality) cleaning.

If any oil / grease is present, it has to be removed with alkaline detergent before Paint application.

Paint System : Painting system as detailed under Section 2 of Appendix (2), "Painting System for Repairs" to be followed. If small areas are involved and application is by brush, several coats may be required to achieve the correct dry film thickness. If the area is large then airless/air spray has to be employed.

6.3 Repair when primer and second coat is intact but third coat is damaged.

This covers the repairs to areas damaged either at the initial coating stage or caused during service, mechanical damages, handling damages etc. damages, etc.

The principle requirements are:

- i. Removal of any corrosion by means of either vacuum blasting or hand tools like disc sander and grinder.
- ii. Abrade the area surrounding the repair for subsequent paint application.

Surface Preparation : Proper feathering and roughening at the coating damaged area. Salt contamination to be checked and if it is higher than the acceptable limit, then the surface has to be cleaned using high pressure (34-70MPA) water (of appropriate quality) cleaning.

If any oil / grease are present, it has to be removed with alkaline detergent before Paint application.

Paint System: Painting system as detailed under Section 2 of Appendix (2), “Painting System for Repairs” to be followed.

If small areas are involved and application is by brush, several coats may be required to achieve the correct dry film thickness. If the area is large then airless/air spray has to be employed.

7. INSPECTION

Inspection of supplied paints, In-process inspection and Final inspection shall be carried out as per approved field quality plan, project specification and manufacturer's work instructions / recommendations.

Approved format for documentation shall be followed throughout the project.

Inspection shall be carried out in stages as per approved QAP/FQP/MQP. Dry film thickness and humidity shall be inspected.

Batch test certificates of all the supplied paint materials to be submitted for review and incase of doubt samples shall be collected for laboratory tests.

Suspected paint quality judged by visual inspection, shall be notified to supplier and shall be used only after laboratory confirmation.

7.1 In-process Inspection

The painting work shall be subject to the In-process Inspection which needs the inspection by Qualified Paint Manufacturer's Inspector in the full course of work steps.

Technical representative of Paint manufacturer shall establish the surface preparation and painting system / methodology, practical coverage before starting the work.

Technical representative of Paint manufacturer shall be deputed at site full time for In- process inspection and tests.

7.2 Inspection of Surface Preparation

The prepared surfaces shall be compared with the standard photographs of SIS, ISO or SSPC. Where the prepared surfaces are deemed to be equivalent to those indicated in the above standard photographs, they shall be deemed acceptable.

Surface profile measurement for blasted surface shall be carried out by using calibrated surface profile gauge.

7.3 Inspection of Paint Film**7.3.1 Appearance**

Paint film shall be visually checked with regard to the following:

Unfinished surface, drips, wrinkles, blistering, peeling, cracking, crawling, discoloring, stains, pinholes, and spray dust. Where there are no marked defects in appearance, the paint film shall be deemed acceptable.

7.3.2 Paint film thickness**1. Measurement**

- a) Film thickness shall be measured with appropriate measuring instruments. All calibrated instruments and measuring devices shall be in the scope of CONTRACTOR
- b) As a rule, film thickness shall be measured for the total dry film thickness.

2. Number of measurements and measured values:

- a) The number and position of measurements shall be determined with due consideration given to the size and shape of items to be painted.
- b) Measurements shall be carried out three times at each measuring point. The average of three measurements shall be taken as the measured value for the item concerned.

3. Rating of measured value

Dry film thickness measurement shall be carried out as per the SSPC-PA 2. When the measured values satisfy the following requirements, they shall be deemed acceptable:

- a) Average of measured film thickness : 95% or more of prescribed film thickness.
- b) Minimum of measured film thickness : 85% or more of prescribed film thickness

Technical representative of paint manufacturer shall certify the paint quality from surface preparation to final inspection, final acceptance of paint and shall issue the inspection report.

8. TESTING**8.1 ADHESION TEST**

After given curing time, the area of interest for the checking of adhesion test. It should be free from dust & oil. Make a x cut with the short edge tool above the area of interest and maintain the angle between the x is 15 degree to 30 degree. Then affix one inch adhesion tape over the cut and peel off the same immediately. If the paint stuck the adhesion tape, it is recommended to re-blast the area and repaint the primer. Frequency and area of test to perform shall be as per paint manufacturer and client recommendations. Acceptance value 5A as per ASTM D 3359

8.2 PULL OUT / DOLLY TEST

Dolly test frequency / scope shall be performed as per Paint manufacturer and OWNER recommendations.

Pull out / Dolly test with acceptance value 5MPa, X Cut acceptance value 5A.

8.3 HOLIDAY TEST

Holiday test or a Continuity test is one of the non Destructive test method applied on protective coatings to detect unacceptable discontinuities such as pinholes and voids, etc.

Holiday testing shall be conducted in accordance with NACE SP 0188. For aboveground, underground / immersion services, 100% of coated area shall be inspected for holidays.

For atmospheric exposure, 50% of coated area (random) which must include weld seams, corners and edges to be holiday tested.

Voltage at which test is to be carried out will depend upon DFT of coating being tested and shall be as per NACE SP 0188.

Any holiday is unacceptable and should be marked and repaired immediately. CONTRACTOR shall provide the necessary equipment for calibrating the holiday detector.

9. GUARANTEE

Painting system shall be selected as per recommendation of OWNER and Paint manufacturer to get the guaranteed performance of paint.

Selected painting system shall be capable of providing minimum 10 years maintenance free performance.

10. FIELD SAFETY AND HYGIENE

Safety and hygiene in connection with the painting work shall be controlled sufficiently. Special care shall be taken with regard to the following matters:

1. When surfaces are to be prepared by blast cleaning or the use of power tools, use protectors such as goggles, as necessary.
2. When painting work is to be carried out using organic solvent in an almost airtight environment, provide appropriate ventilating and lighting equipment. Additionally, wear appropriate protectors such as gas masks.
3. Monitor the use of fire around the work location and remove any fire deemed to be unsafe.

11. FIELD STORAGE AND CONTROL OF PAINT MATERIALS

11.1 Storage

1. As a rule, paint materials shall be stored in a well-ventilated room.
2. When paint materials is stored outdoors, it shall be protected using sheets or other appropriate measures, in order to prevent damage to containers or changes in the quality of the paint materials
3. For storage areas, provide prescribed protective measure and signs. Paint materials exceeding the prescribed amount shall not be stored.
4. When paint materials are temporarily stored in the working area, the amount equivalent to one

day's use or less shall be stored. Paint materials shall be protected from rain, etc. using sheets.

5. When paint materials are temporarily stored in the working area, the amount equivalent to one day's use or less shall be stored. Paint materials shall be protected from rain, etc. using sheets.
6. CONTRACTOR shall ensure that the paint materials are applied within the shelf life and pot life. Materials which have not been applied within the pot-life / shelf life duration shall be discarded and properly disposed of.

11.2 Quality Control of Stored Paint materials

1. All paint materials and thinner shall be stored in such a way that the manufacturer's labels can be readily identified.
2. Stocks of paint materials shall be controlled so that they can be used within their effective period of use.
3. Care shall be taken with storing and handling to avoid breakage or marked deformation of containers
4. Paint materials shall be delivered to Site in the original containers bearing manufacturer's name, product designation, batch number, shelf life and date of manufacture
5. Batch test certificate of all the paint material supplied shall be submitted for OWNER's review before use. CONTRACTOR shall carry out Batch paint testing in the event of OWNER's request / order without any additional cost to OWNER.

12. TRANSPORTATION

1. Painted products shall not be moved or transported until the required curing period has elapsed.
2. Painted products shall be handled, moved or transported in such a manner as will not damage the paint film. To this end, appropriate protective measures shall be taken.

Appendix - 1 "Detail of Painting System"

Surface preparation & Coating system applicable for All Non-insulated & Insulated Shop & Site Manufactured Items as well as Bought-out Items including Mechanical, Electrical, Instrumentation & Automation Items

JOTUN / HEMPEL / Akzo Nobel India Limited

1 For external surfaces of Non-insulated Items

1.1 CS / LTCS surfaces of NON-CRYOGENIC services

Painting System No. 1.1.1 (CS surfaces)

Applicable Operation Temperature T (C): $0 < T \leq 120$

Activity	Step No.	Spec. or Paint Material	Nos. of Coat	Dry Film Thickness (μ/coat)
Surface Preparation	1	SSPC-SP10, Abrasive : Copper Slag, Profile : 50 μm - 70 μm	-	-
Prime Coat	2	Two Component Moisture curing Inorganic Zinc Ethyl Silicate Coating confirming the requirement of SSPC Paint 20, Level I and complies ASTM D520 Type II Zinc Dust.	1	75
Intermediate Coat	3	Two Component High Build Epoxy with High Build Epoxy MIO	1	150
Final Coat	4	Two Component Chemically curing Aliphatic Acrylic Polyurethane Coating	1	75
				TOTAL DFT 300 μ

Painting System No. 1.1.2 (LTCS surfaces)

Applicable Operation Temperature T (C): $-48 < T \leq 200$

Activity	Step No.	Spec. or Paint Material	Nos. of Coat	Dry Film Thickness (μm/coat)
Surface Preparation	1	SSPC-SP10, Abrasive : Copper Slag, Profile : 50 μm - 70 μm	-	-
Prime Coat	2	Two component polyamine cured phenolic and novolac epoxy coating	1	150
Intermediate Coat	3	Two component polyamine cured phenolic and novolac epoxy coating	1	150
Final Coat	4	Two Component Chemically curing Aliphatic Acrylic Polyurethane Coating	1	75
				TOTAL DFT 375 μ

1.2 SS surfaces of NON-CRYOGENIC services
Painting System No.1.2.1

 Applicable Operation Temperature T (C): $0 < T \leq 70$

Activity	Step No.	Spec. or Paint Material	Nos. of Coat	Dry Film Thickness (μ/coat)
Surface Preparation	1	Sweep Blasting, Abrasive : Garnet, Profile : 40 μm - 60 μm	-	-
Prime Coat	2	Two component polyamine cured phenolic and novolac epoxy coating	1	150
Intermediate Coat	3	Two component polyamine cured phenolic and novolac epoxy coating	1	150
Final Coat	4	Two component Chemically curing Aliphatic Acrylic Polyurethane Coating	1	75

TOTAL DFT 375 μ

2 For external surfaces of structures etc.
Painting System No. 2.1
Applicable Operation Temperature T (°C): $0 < T \leq 100$

Activity	Step No.	Spec. or Paint Material	Nos. of Coat	Dry Film Thickness (μ/coat)
Surface Preparation	1	SSPC-SP10, Abrasive : Copper Slag, Profile : 50 μm - 70 μm	-	-
Prime Coat	2	Two Component Moisture curing Inorganic Zinc Ethyl Silicate Coating confirming the requirement of SSPC Paint 20, Level I and complies ASTM D520 Type II Zinc Dust.	1	75
Intermediate Coat	3	Two Component High Build Epoxy with High Build Epoxy MIO	1	150
Final Coat	4	Two Component Chemically curing Aliphatic Acrylic Polyurethane Coating	1	75
				TOTAL DFT 300 μ

3 For Insulated Tank, Piping, Valves, Pumps, Motors and All Equipment of Carbon Steel / LTCS /SS
3.1 SS/ CS / LTCS surfaces of low temperature services Tanks
Painting System No. 3.1
Applicable Operation Temperature T (°C): $-48 < T \leq 200$

Activity	Step No.	Spec. or Paint Material	Nos. of Coat	Dry Film Thickness (μm/coat)
Surface Preparation	1	SSPC-SP10, Abrasive : Copper Slag, Profile : 50 μm - 70 μm	-	-
Prime Coat	2	Two component polyamine cured phenolic and novolac epoxy coating	1	150
Final Coat	3	Two component polyamine cured phenolic and novolac epoxy coating	1	150
				TOTAL DFT 300 μ

Notes: 1. Dolly test / Pull Out – Acceptance value is 5Mpa.

2. Painting performance guarantee / durability maintenance free for 10 years.

Appendix - 2 "Detail of Painting System - Repairs"

REPAIR PAINT SYSTEM -2A WHEN PRIMER IS INTACT BUT SECOND COAT IS DAMAGED

1 For external surfaces of Non-insulated Items

1.1 CS / LTCS surfaces of NON-CRYOGENIC services

Painting System No. 1.1.1

Applicable Operation Temperature T (C): $0 < T \leq 120$

Note: Scheme shall be applicable as stated above in appendix 1

Activity	Step No.	Spec. or Paint Material	Nos. of Coat	Dry Film Thickness (μ/coat)
Surface Preparation	1	Proper feathering and roughening at the coating damaged area	-	-
Prime Coat	2	Not Applicable	-	-
Second coat	3	Two component polyamine cured high build mastic epoxy pigmented with Laminar aluminum flakes	1	100
Third coat	4	Two component high build Epoxy MIO	1	150
Final Coat	5	Two Component Chemically curing Aliphatic Acrylic Polyurethane Coating	1	75

TOTAL DFT 325 μ
 (Excluding Prime coat DFT)

1.2 SS surfaces of NON-CRYOGENIC services
Painting System No.1.2.1
Applicable Operation Temperature T (° C): 0 < T ≤ 70

Activity	Step No.	Spec. or Paint Material	Nos. of Coat	Dry Film Thickness (μ/coat)
Surface Preparation	1	Proper feathering and roughening at the coating damaged area	-	-
Prime Coat	2	Not Applicable	-	-
Intermediate Coat	3	Two Component Polyamine cured Phenolic and Novolac Epoxy Coating	1	150
Final Coat	4	Two Component Chemically curing Aliphatic Acrylic Polyurethane Coating	1	75
TOTAL DFT				225 μ

2 For external surfaces of structures etc.
Painting System No. 2.1
Applicable Operation Temperature T (° C): 0 < T ≤ 100

Activity	Step No.	Spec. or Paint Material	Nos. of Coat	Dry Film Thickness (μ/coat)
Surface Preparation	1	Proper feathering and roughening at the coating damaged area	-	-
Prime Coat	2	Not Applicable	-	-
Second coat	3	Two component polyamine cured high build mastic epoxy pigmented with Laminar aluminum flakes	1	100
Third coat	4	Two component high build Epoxy MIO	1	150
Final Coat	5	Two Component Chemically curing Aliphatic Acrylic Polyurethane Coating	1	75

(Excluding Prime coat DFT) TOTAL DFT 325 μ

3 For Insulated Tank, Piping, Valves, Pumps, Motors and All Equipment of Carbon Steel / LTCS /SS
3.1 SS/ CS / LTCS surfaces of low temperature services
Painting System No. 3.1
Applicable Operation Temperature T (° C): - 48 < T ≤ 200

Activity	Step No.	Spec. or Paint Material	Nos. of Coat	Dry Film Thickness (μ/coat)
Surface Preparation	1	Proper feathering and roughening at the coating damaged area	-	-
Prime Coat	2	Surface Tolerant Two Component Polyamine cured Phenolic and Novolac	1	150
Final Coat	3	Surface Tolerant Two Component Polyamine cured Phenolic and Novolac Epoxy Coating	1	150

TOTAL DFT 300 μ

REPAIR PAINT SYSTEM -2B WHEN PRIMER & SECOND COAT IS INTACT BUT THIRD COAT IS DAMAGED
1 For external surfaces of Non-insulated Items
1.1 CS / LTCS surfaces of NON-CRYOGENIC services
Painting System No. 1.1.1
Applicable Operation Temperature T (C): $0 < T \leq 120$

Activity	Step No.	Spec. or Paint Material	Nos. of Coat	Dry Film Thickness (μ/coat)
Surface Preparation	1	Proper feathering and roughening at the coating damaged area	-	-
Prime Coat	2	Not Applicable	-	-
Intermediate Coat	3	Two Component Polyamine cured High build Mastic Epoxy pigmented with Laminar Aluminium Flakes	-	100
Final Coat	4	Two Component Chemically curing Aliphatic Acrylic Polyurethane Coating	1	75

TOTAL DFT 175 μ

1.2 SS surfaces of NON-CRYOGENIC services

Painting System No.1.2.1

Applicable Operation Temperature T (° C): 0 < T ≤ 70

Activity	Step No.	Spec. or Paint Material	Nos. of Coat	Dry Film Thickness (μ/coat)
Surface Preparation	1	Proper feathering and roughening at the coating damaged area	-	-
Prime Coat	2	Not Applicable	-	-
Intermediate Coat	3	Two component polyamine cured phenolic and novolac epoxy coating	1	100
Final Coat	4	Two Component Chemically curing Aliphatic Acrylic Polyurethane Coating	1	75

TOTAL DFT 175 μ

2 For external surfaces of structures etc.
Painting System No. 2.1

Applicable Operation Temperature T (° C): 0 < T ≤ 100

Activity	Step No.	Spec. or Paint Material	Nos. of Coat	Dry Film Thickness (μ/coat)
Surface Preparation	1	Proper feathering and roughening at the coating damaged area	-	-
Prime Coat	2	Not Applicable	-	-
Intermediate Coat	3	Two Component Polyamine cured High build Mastic Epoxy pigmented with Laminar Aluminum Flakes	1	100
Final Coat	4	Two Component Chemically curing Aliphatic Acrylic Polyurethane Coating	1	75

TOTAL DFT 175 μ

3 For Insulated Tank, Piping, Valves, Pumps, Motors and All Equipments of Carbon Steel / LTCS

3.1 SS/CS / LTCS surfaces of low temperature services

Painting System No. 3.1

Applicable Operation Temperature T (° C): - 48 < T \leq 200

Activity	Step No.	Spec. or Paint Material	Nos. of Coat	Dry Film Thickness (μ/coat)
Surface Preparation	1	Proper feathering and roughening at the coating damaged area	-	-
Prime Coat	2	Not Applicable	-	-
Final Coat	3	Surface Tolerant Two Component Polyamine cured Phenolic and Novolac Epoxy Coating	1	150

TOTAL DFT

15

Annexure - 1

PAINTING SYSTEM FOR BOUGHT-OUT MATERIAL / EQUIPMENTS / COMPONENTS

1. MOC CS ENCLOSURE ELECTRICAL PANEL

- Surface Preparation: Zinc Phosphate pretreatment (8 Tank Bath Cleaning Process)
- Primer coat: **Interpon APP 120 (Akzo) or equivalent** Zinc Base Powder Primer at a DFT of 80 Microns
- Finish coat : **Interpon D 1036 (Akzo) or equivalent** Polyester Glossy or SG Powder at a DFT of 80 Microns.
- Total DFT : 160 Microns min.
- Colour Shade : As per OWNER's recommendation
- Approved makes : AKZONOBLE / JOTUN / HEMPLE / SIGMA.

Salt deposition test shall be carried out (acceptable value Max value - 5 micro gram / cm²) , Adhesion test (1) X cut –minimum value - 5A ,

Pull out / Dolly Test - minimum value 5 MPa

Full time deployment of Paint Manufacturer Technical Representative for stage inspection is mandatory requirement

2. MOC SS ENCLOSURE ELECTRICAL PANEL

- Surface Preparation: Garnet Blasting / Non Metallic Abrasive with profile 40-60 Microns
- Primer: Powder Base Pure Epoxy - 80 Microns
- Top coat powder: Durable pure polyester- 80 Microns
- Total DFT : 160 Microns
- Color Shade : As per OWNER's recommendation
- Approved makes : AKZONOBLE / JOTUN / HEMPLE / SIGMA.

Salt deposition test shall be carried out (acceptable value Max value - 5 micro gram / cm²) , Adhesion test (1) X cut –minimum value - 5A ,

Pull out / Dolly Test - minimum value 5 MPa

Full time deployment of Paint Manufacturer Technical Representative for stage inspection is mandatory requirement

3. MOC ALUMINIUM ENCLOSURE ELECTRICAL PANEL

- Surface Preparation: 8 Tank chormating pretreatment
- First coat: Pure Epoxy - 80 Microns
- Second Coat: Pure Polyester - 80 Microns
- Total DFT : 160 Microns

- Colour Shade : As per OWNER's recommendation

- Approved makes : AKZONOBLE / JOTUN / HEMPLE / SIGMA.

Salt deposition test shall be carried out (acceptable value Max value - 5 micro gram / cm²), Adhesion test
(1) X cut –minimum value - 5A,

Pull out / Dolly Test - minimum value 5 MPa

Full time deployment of Paint Manufacturer Technical Representative for stage inspection is mandatory requirement.

4. ALUMINIUM CASTING FOR VALVES AND ENCLOSURE ELECTRICAL PANEL

- Surface Preparation: 8 Tank Chormating Pretreatment

- First coat: Epoxy Polyester - 80 Microns

- Second Coat: Epoxy Polyester - 80 Microns

- Total DFT: 160 Microns

- Colour Shade: As per OWNER's recommendation

- Approved makes: AKZONOBLE / JOTUN / HEMPLE / SIGMA.

Salt deposition test shall be carried out (Acceptable Value - Max value - 5 micro gram / cm²), Adhesion test

(1) X cut – minimum value - 5A ,

Pull out / Dolly Test - minimum value 5 MPa

Full time deployment of Paint Manufacturer Technical Representative for stage inspection is mandatory requirement

5. TRANSFORMER

- Surface preparation : Sand blasting / Shot blasting to achieve SA 2.5 Finish

(50 -75 Microns surface profile)

- Primer Coat : Two Component Moisture Curing Zinc (Ethyl) Silicate Primer - 75 Microns min. (Product Sigmazinc 158 or Equivalent from Approved Make)

- Intermediate: Two Component High Build Micaceous Iron Oxide Pigmented Polyamide Cured recoatable Epoxy Coating: 125 Microns min (Product Sigma cover 435 or Equivalent from Approved Make)

- Final coat 1 : Two Component High Build Polyamide Cured Recoatable Epoxy Coating : 100 Microns min. (Product Sigmacover 456 or Equivalent from Approved Make)

- Final Coat 2 : ACRYLIC ALEPHATIC PU- 50 Microns

- Total DFT : 350 Microns min. With +10% tolerance.

- Colour Shade : As per OWNER's recommendation

Specific Note : Before every coat, strip coat on edges of fins and transformers is must.

COATING ON FINS – After Galvanizing, Coating - 80 Microns Min.

- POLYAMIDE PURE EPOXY MIO: - 50 µm min.
- HIGH BUILD EPOXY POLYMIDE: 100 Microns
- TOP COAT PU : 50 Microns
- Total DFT : 200 Microns
- Colour Shade : As per OWNER's recommendation
- Approved makes : AKZONOBLE / JOTUN / HEMPLE / SIGMA.

Salt deposition test shall be carried out (Acceptable Value - Max value - 5 micro gram / cm²) , Adhesion test

(1) X cut – minimum value - 5A ,

Pull out / Dolly Test - minimum value 5 MPa

Full time deployment of Paint Manufacturer Technical Representative for stage inspection is mandatory requirement.

6. ZINC GALVANISED PANELS SURFACE NOT INCLUDED PIPES

- Surface preparation : 8 Tank Zinc Phosphating Pretreatment
- First coat : Pure Epoxy - 80 Microns
- Second Coat : Epoxy Polyester - 80 Microns
- Total DFT : 160 Microns
- Colour Shade : As per OWNER's recommendation
- Approved makes : AKZONOBLE / JOTUN / HEMPLE / SIGMA.

Salt deposition test shall be carried out (Acceptable Value - Max value - 5 micro gram / cm²) , Adhesion test

(1) X cut – minimum value - 5A ,

Pull out / Dolly Test - minimum value 5 MPa

Full time deployment of Paint Manufacturer Technical Representative for stage inspection is mandatory requirement

7. FASTENERS-HIGH TENSILE UPTO 8.8 Grade (After Torque Tightening) Hot

Dipgalvanized : 80-100 Microns

- Surface Preparation : Degrease and Pre-clean with Galvanized Iron Pre-Cleaner.
- Primer coat : Etch primer, 15-20 Microns min
- Intermediate Coat : Twin Pack High Solid High Build Polyamide Cured Epoxy MIO Aluminium Pigmented, 150 Microns min
- Final Coat : Twin Pack Acrylic Aliphatic Polyurethane, 70 Microns min
- Total DFT : 340 Microns (including Galvanising)
- Colour Shade : As per OWNER's recommendation
- Approved makes : AKZONOBLE / JOTUN / HEMPLE / SIGMA.

Salt deposition test shall be carried out (Acceptable Value - Max value - 5 micro gram / cm²) , Adhesion test

(1) X cut – minimum value - 5A ,

Pull out / Dolly Test - minimum value 5 MPa

Full time deployment of Paint Manufacturer Technical Representative for stage inspection is mandatory requirement

8. HANDRAIL AND GRATING

Painting System on Hand Rail and Gratings (Hot Dip Galvanized 610 GSM in case thickness less than 5 mm, 910 GSM in case thickness above 5 mm)

a. HAND RAIL AND GRATINGS thickness 5 mm and below

SCHEME A

1. Galvanizing : 90 Microns
2. Surface preparation : Light Sweep Blasting with Non-Metallic Abrasive
3. Etch Primer : 10-15 Microns, then Surface Tolerant Primer : 100 -125 Microns
4. High Build Epoxy MIO : 100-125 Microns

In no case Total DFT less than 300 Microns (including galvanizing) shall be accepted.

SCHEME B

1. Galvanizing : 90 Microns
2. Surface preparation : Light Sweep Blasting with Non-Metallic Abrasive
3. Pure Epoxy Primer : 50 - 60 Microns DFT
4. High Build Epoxy MIO : 100-125 Microns DFT

In no case Total DFT less than 250 Microns (including galvanizing) shall be accepted.

b. HAND RAIL AND GRATINGS thickness 5 mm and ABOVE

SCHEME A

1. Galvanizing : 130 Microns
2. Surface preparation : Light Sweep Blasting with Non-Metallic Abrasive
3. Etch Primer : 10-15 Microns, then Surface Tolerant Primer : 100 -125 Microns
4. High Build Epoxy MIO : 100-125 Microns

In no case Total DFT less than 340 Microns (including galvanizing) shall be accepted.

SCHEME B

1. Galvanizing: 130 Microns
2. Surface preparation: Light Sweep Blasting with Non-Metallic Abrasive
3. Pure Epoxy Primer: 50 - 60 Microns DFT
4. High Build Epoxy MIO: 100-125 Microns DFT

In no case Total DFT less than 290 Microns (including galvanizing) shall be accepted.

- Color Shade: As per OWNER's recommendation
- Approved makes: AKZONOBLE / JOTUN / HEMPLE / SIGMA.

Salt deposition test shall be carried out (Acceptable Value - Max value - 5 micro gram / cm²) , Adhesion test (1) X cut – minimum value - 5A ,

Pull out / Dolly Test - minimum value 5 MPa (This value is applicable for Secondary supporting non critical STR only)

Full time deployment of Paint Manufacturer Technical Representative for stage inspection is mandatory requirement.

NOTES**1. Wrapping Coating System for Underground Piping**

Procedure for Surface Preparation, Painting, Wrapping and Coating, Document No: **Annexure – 2₁** shall be referred for Wrapping coating on Underground Piping.

2. Following items should be shield / protected during surface preparation / painting

- Name Plates
- Pressure gauge, flow indicator glasses
- Valve Stems
- Packing glands & seals
- Rotary equip. coupling & shafts
- Vents
- Rubber & Plastic Parts

After operations, the shielding to be removed.

Annexure - 2

**PROCEDURE FOR SURFACE PREPARATION, PAINTING, WRAPPING
AND COATING**

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1) PURPOSE :

The purpose as discussed is to carry out the copper slag blasting & primer painting of all M.S structural steel and pipes. In a systematic way to minimize available errors and to provide guidelines for best achievement in copper slag blasting & painting.

2) SCOPE:

This procedure covers the requirements for surface preparation & application of paint on external surface of M.S structural steel and pipes

3) REFERENCE DOCUMENTS :

- I. Paint manufacturer's instruction & safety data sheet.
- II. Technical data sheets for paints/touch – up paints system.
- III. Surface preparation shall be carried out in accordance with project technical specification.
- IV. ISO 12944.
- V. ISO 8501.
- VI. ASTM-D-3359.
- VII. SSPC PA-2.
- VIII. ISO 8504.
- IX. ISO 8502.

4) SIGNIFICANCE OF SURFACE PREPARATION STRUCTURE & ABOVE GROUND PIPING:

- Oil or grease, salts, dirt, chalk marks and similar contaminants shall be removed as far as possible, prior to surface preparation, using an appropriate method in accordance with ISO 12944-4.
- Sharp Edges, Weld spatter, Cavities and Deformations are to be removed in accordance with ISO 8501-3, table-3.
- Assess the steel surface for Rust grades as per ISO 8501-1.
- Surface shall be cleaned by abrasive blast cleaning (ISO 12944-4 Cl.6.2.3.1.2) in accordance with ISO 8504-2 (Cl. 5.1.2).
- Surface cleanliness shall be as per Sa2.5 and surface profile shall be 50-75 μ in accordance with ISO 8502-4.
- Weld joints shall be covered by mask tape 200 mm on both sides.
- Surface salts concentration (e.g. Chloride deposits) shall be 5 μ g/cm² prior to painting. If the value exceeds acceptable limit, surface to be cleaned using high pressure water cleaning 34-70MPA. Washing to be followed by drying and sweep blasting to required standard.

Compressed Air:

- Air used for blasting must be clean, oil free and dry. Moisture and Oil separators have to be used to ensure the same.
- The pressure should be at least 7kg per cm² (100lbs per inch²) at the nozzle.

Abrasive:

- Abrasive used for blasting should be dry and free from dirt, oil, grease or contamination and have content of water soluble matter not exceeding 0.05%.
- The abrasive must be capable of producing the standard of cleanliness and surface profile specified. (Sa2.5 and profile of 50-70 microns).
- Abrasives like copper slag shall be used only one time, and should not be contaminated with soil.
- Size of copper slag shall be range of 0.5 to 2.0 mm.

Cleaning:

- Before initial blast inspection, the bulk of the spent abrasive should be removed. Any substandard areas should be identified and repaired. All paint marking, chalk etc., must be removed after rectification.
- Fabrication repair (if any) should be carried out before application of the primer.
- Following inspection of the blast profile and standard, remaining traces of abrasive and dust should be removed from all areas.

5) PAINT APPLICATION :**Weather Conditions**

- Surfaces to be coated must have a temperature at least 3°C (5°F) above the dew point, immediately following blasting and priming, intermediate and topcoat application, and must also remain in this condition during curing of the coatings.
- As a guide, relative humidity levels of 25-80% give optimum painting conditions, although some applications may be carried out up to 85% relative humidity.
- Painting can be carried out on steel temperature up to 45 deg C.
- Painting should not be carried out during windy conditions.

General Site Requirements

Prior to any work being carried out there are a number of conditions which must be met.

a) Cleanliness:

Any contaminants which may come in contact with the steel (even before surface preparation comments) can compromise the performance protective coating system, and as such all effort must be made to keep the working area clean. It is good working practice to establish a clean area where painting is being done. Cleanliness must be maintained throughout all stages of the application.

b) Weather Shelters:

Weather shelters should be made available to cover application equipment during mixing and application of material.

c) Paint Storage Facility:

All paints should be stored ideally between 10°C (50°F) and 30°C (86°F) and Facilities may be needed to store the materials in the correct temperature range prior to mixing and application.

6) STRIPE COATING:

A coating system may consist of a coat of an anticorrosive material (primer) and one or more stripe coats. Stripe coats are applications of the top-coat (paint) which has been applied to edges of structure, welds, drain holes and other areas to over-come potential problems that can result when paint coverage is difficult/insufficient or non-uniform.

Stripe coat is generally applied with combination of airless spray & brush application method to get specific DFT.

7) UNDER GROUND PIPE LINE SURFACE PREPARATION , PAINTING , WRAPPING & COATING:

After completion of weld visual and NDT Clearance wrapping and coating to be carried out as per given detail below--

SIGNIFICANCE OF SURFACE PREPARATION :-

- Oil or grease, salts, dirt's, chalk marks and similar contaminants shall be removed as far as possible, prior to surface preparation, using an appropriate method in accordance with ISO 12944-4.
- Sharp Edges, weld spatter, cavities and deformations are to be removed in accordance with ISO 8501-3, table-3
- Assess the steel surface for Rust grades as per ISO 8501-1
- Surface shall be cleaned by abrasive blast cleaning (ISO 12944-4 Cl.6.2.3.1.2) in accordance with ISO 8504-2 (Cl. 5.1.2)
- Surface cleanliness shall be as per Sa2.5 and surface profile shall be 50-70 μ in accordance with ISO 8502-4
- Weld joints shall be covered by mask tape 200 mm on both sides.
- Surface salts concentration (e.g. Chloride deposits) shall be 5 $\mu\text{g}/\text{cm}^2$ prior to painting. If the value exceeds acceptable limit, surface to be cleaned using high pressure water cleaning 34-70MPA.
- Washing to be followed by drying and sweep blasting to required standard.

Compressed Air

- Air used for blasting must be clean, oil free and dry. Moisture and Oil separators have to be used to ensure the same.
- The pressure should be at least 7kg per cm² (100lbs per inch²) at the nozzle.

Abrasive

- Abrasive used for blasting should be dry and free from dirt, oil, grease or contamination and have content of water soluble matter not exceeding 0.05%.
- The abrasive must be capable of producing the standard of cleanliness and surface profile specified. (Sa2.5 and profile of 50-75 microns)
- Abrasives like copper slag should not be recycled more than once, and should not be contaminated with soil.
- Size of copper slag shall be range of 0.5 to 2 mm.

Cleaning

- Before initial blast inspection, the bulk of the spent abrasive should be removed. Any substandard areas should be identified and repaired. All marking paint, chalk etc., must be removed after rectification.
- Fabrication repair (if any) should be carried out before application of the primer.
- Following inspection of the blast profile and standard, remaining traces of abrasive and dust should be removed from all areas.

PRIMER APPLICATION— Self priming / surface tolerant high build Coal Tar Epoxy @ 100 X 1= 100 Microns shall be applied over blasted surface SA 2.5 as mentioned in specification.

Approved make: Rust-O-Seal Volume solid 70% (M/s Asian paint make or equivalent e.g. M/s STP make, PYPKOTE).

Repair of minor/major areas when primer paint is affected:

A major repair should be deal with as if the project were beginning. The recommendations given earlier for pipe preparation, coating application, must all Adhered to. The original complete coating scheme should be applied. This is applied when primer is damaged. After ensuring necessary surface preparation as above.

Apply

Application of wrap coat system- Hot applied coal Tar based tape system with compliance of AWWA-C-203 / SSPC-PS 10.01 / IS 15337 latest editions.

- Wrap coat system to be applied after hard dry curing of coal tar epoxy primed surface.
- Necessary care to be taken to avoid burn out of primed coal tar epoxy surface.

Adhesive layer between Coal tar Epoxy primed surface / 1st wrap / 2nd wrap – Fast drying, resin based Synthetic primer containing only unmodified chlorinated rubber & small amount of coal tar pitch to make adhesive layer with subsequent coal tar tape.

-DFT: 25-40 micron DFT.

First Wrap- Specially formulated coal tar wrap tape having both side glass fiber high tensile fabric & having polyethylene film to facilitate unwinding.

- Tape layer thickness: 2 mm
- Width & length of Tape: As per requirement of pipe dia.

Second Wrap- Specially formulated coal tar wrap tape having both side glass fiber high tensile fabric & having polyethylene film to facilitate unwinding, in staggered pattern over first layer .

- Tape layer thickness: 2 mm
- Width & length of Tape: As per requirement of pipe dia.

Pattern of Wrapping- Spiral / wrap with minimum overlap of 25 mm in single wrap, 50 mm in case of wrapping and coating of field joints.

Approved Make of wrap coat system- “Jet site Primer Type C & Pipe wrap CT” of M/s STP limited make or equivalent.

Holiday test--Holiday test with holiday detector to be checked at the 15000 VOLTS current as per the IS: 15337 Latest edition after completion of the 2nd layer application to detect the faults, holes, breaks or conductive particles in the protective coating. If there is any leakage then after repair same process will be repeated.

8) Quality Inspection:**• Paint quality check:**

Inspection shall be carried out in stages as per approved QAP/FQP. Dry film thickness and Humidity shall be inspected. Profile measurement for blasted surface shall be carried with surface profile gauge.

Suspected paint quality judged by visual inspection, shall be noticed to supplier and after laboratory confirmation is to be used. All the supplied paint material batch test certificate shall be submitted for review before use, incase of doubt sample can be collected for laoratory tests.

• Appearance check:

Coated surface shall be free from holiday, sagging, brush mark, pin hole, orange peel or cracking and dry spray.

• Film thickness control:

WFT shall be measured during painting and recorded for reference. and ensure to obtain the correct DFT in process. DFT measured after curing of coating surface acco. to SSPC PA2.

• Adhesive test:

Adhesive test shall be carry out at randam after each coat and each component and shall be recorded. As per ISO 8501 Adhesion test should be conducted randomly. The dry film thickness of coat shall be checked by means of a calibrated elcometer. Dry thickness gauge re calibration will be done after expiry of the certificate. Periodic and continuous field checks on workmen shall be made to ensure that the correct procedure and paint is applied according to the specification. Defective work shall be corrected as and when identified. A painting log shall be maintained as per the project specification.

Painting Dolly / Pullout Test Acceptance Value Is 5MPa And X-Cut Value 5A

• Guarantee:

Painting performance guarantee / durability maintenance free for 10 years.

Painting system shall be selected as per client and paint manufacturer recommendation to get the guaranteed performance of paint.

9) SAFETY CAUTIONS:

- PPE shall be used during blasting operation & painting.
- Paint material shall be kept away from hot work areas.
- Material data sheets shall be made available at all times.
- Required permits shall be obtained during work progress.

Notes: -

- This Procedure is for reference only, above requirements are minimum requirements. specific requirements shall be included at the time of finalization of specific Procedure submitted by vendor.
- This procedure shall be read in conjunction of relevant standards/Codes/Specification/Client approved QAP/ ITP/Procedure / Drawings / Datasheets / protocol / Contract technical specification / any communication / Good engineering practices adopted by world wise best industries.
- Incase of any conflict only stringent references and acceptances, standards & codes shall be applicable
- Incase any dispute or conflict client decision will be the final decision, will be taken on the basis of practices adopted by world's best industries for the same product/component/activity delivery.
- This Procedure is subjected to change in case of any significant change observed in material requirement, operational requirement and specification requirement.

Annexure - 3

FINAL COLOR CODE FOR PAINTING

Following are the standard final colour shade / RAL code to be followed by contractor for painting system.

The final colour shade may be changed as per Client's requirement which shall be communicated to vendor after purchase order.

S. No.	DESCRIPTION	FINAL LAYER COLOUR SHADE	RAL CODE
1	Pipe Work	Yellow	RAL 1004
2	Piping Support	Grey	RAL 7043
3	Hand Rail	Grey	RAL 7043
4	Gas O/L Actuator	Blue	RAL 5015
5	Valve Handle/Wheel	Black	RAL 9005
6	All Valves	Grey	RAL 7038
7	IJ	Grey	RAL 7038
8	Filter	Grey	RAL 7038
9	Pig launcher & Receiver	Grey	RAL 7038
10	Bolts & Nuts	Grey	RAL 7038
11	Grating	Hot Galvanized	
12	Metering Station Shed		
12.1	Steel Frame	Beige	RAL 1018
12.2	Roof / Vertical Shed	Grey	RAL 7030
12.3	Control Panel	Grey	RAL 7032